Commercial Reusable Suborbital
CRuSR
Research Program

Mission Statement:
Facilitate NASA-sponsored researchers, engineers, technologists and educators access to near-space, regularly, frequently, and predictably at reasonable cost with easy recovery of intact payloads

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Presentation to:
NASA IPP Commercial Space Initiatives - Update
Crystal Gateway Marriott – Arlington, VA
9 February 2010

Commercial Reusable Suborbital Developers

A sample of those who have flown and aspire to Near-Space

Virgin Galactic - Scaled

Blue Origin

XCOR

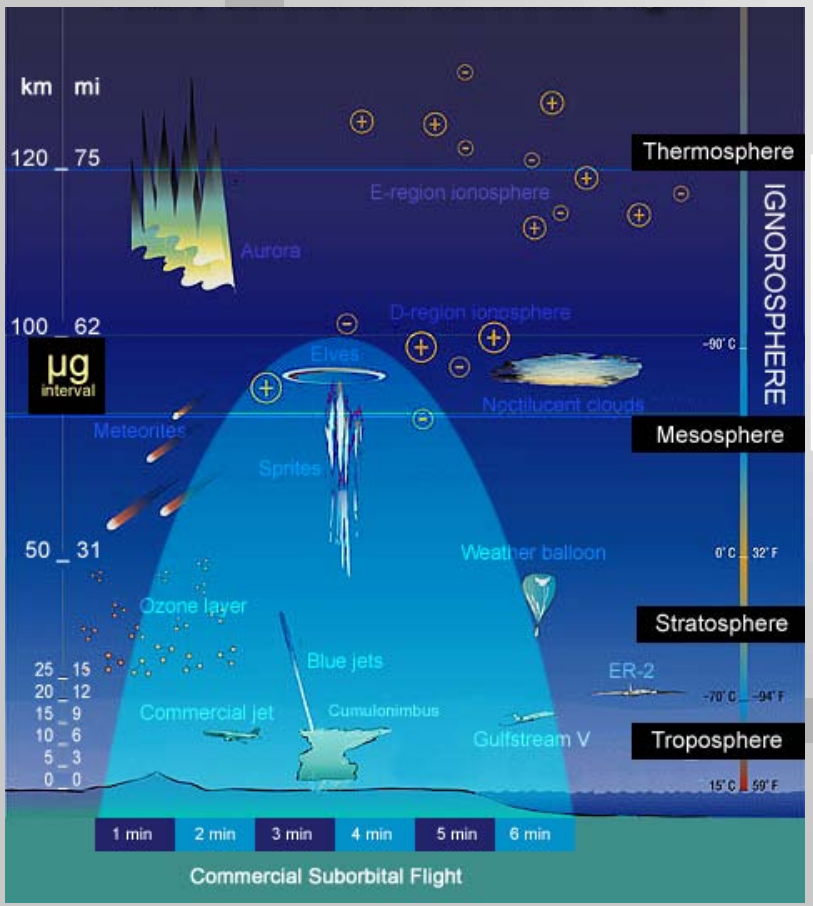
Armadillo Aerospace

Masten Space Systems

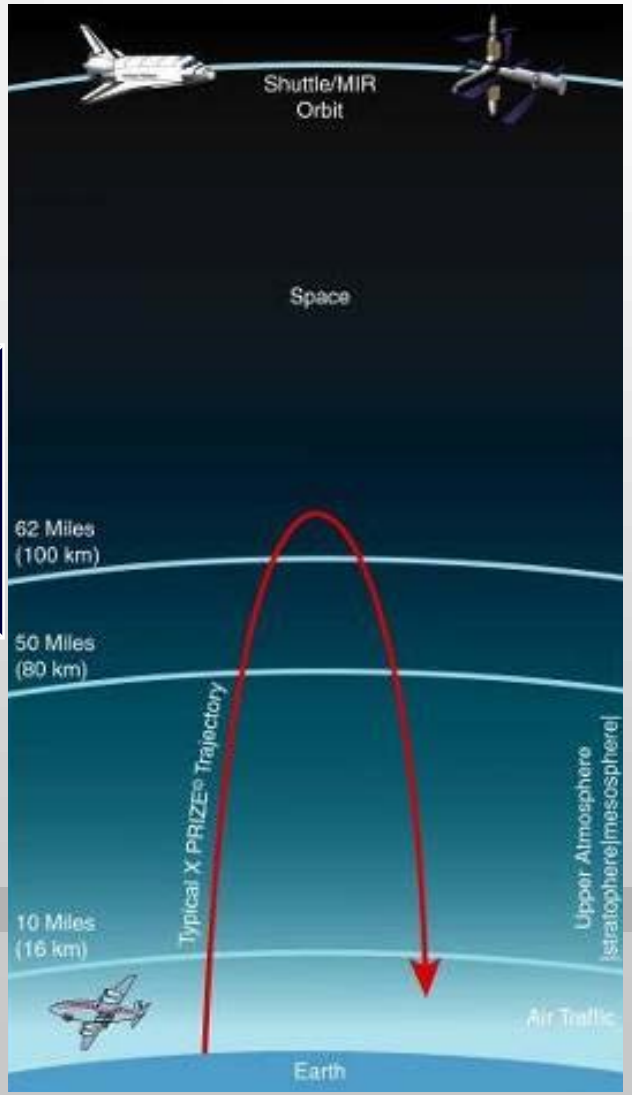
- Horizontal & vertical launch & recovery options
- From 0-6 passengers
- From 0-3 crew
- First full-up test flights in late 2010

Near-Space?

Commercial Reusable Suborbital Flight
- Nominal 3-6 minutes micro-G
- Access to "ignorosphere"



- too low for orbital spacecraft
- too high for aircraft / balloons



Why is NASA Involved in Commercial Space

- Critical Factors for Spaceflight Research
- ACCESS TO SPACE
- More specifically
  - Low-Cost and Reliable Access to Space (LCRATS)
- Similar needs for many complex experiments
  - Late load
  - Controlled environmental conditions on orbit
  - Rapid Payload recovery
  - Benign shock and "g" loads during recovery
  - Mission design favorable to research imperatives
  - Ability to interact with experiment while in orbit
  - Ability to quickly iterate on successive flights

Why is NASA Involved & What is CRuSR?

"…the Commercial Reusable Suborbital Research program… will buy space transportation services from the emerging reusable spaceflight companies to conduct science research, technology development, with a keen focus on education."

Remarks by NASA Administrator Charles Bolden
at the National Association of Investment Companies Washington, DC; 20 Oct 2009

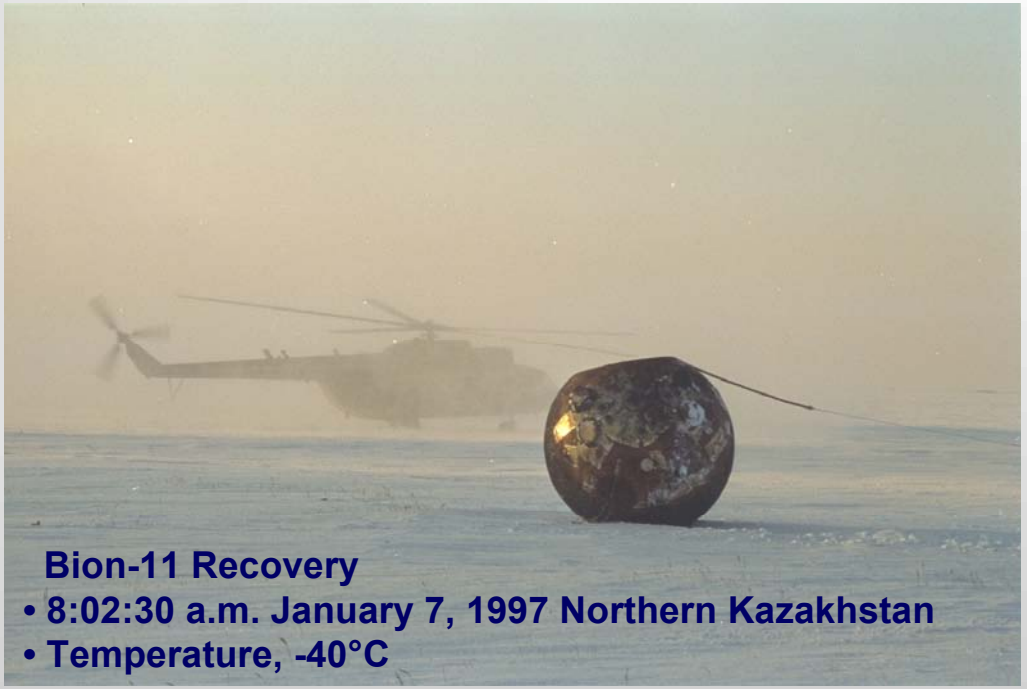
- CRuSR Goals
  - Buy space transportation services from emerging reusable spaceflight companies to conduct science research, technology development, and exploit enormous educational potential of spaceflight
  - Engage the scientific, technical, and educational (user) community to encourage and promote the use of this new opportunity to access Near-Space as a way to inspire "…the next generation of Americans to once again seek become interested in math, science, engineering, and technology so that our nation can maintain its technological leadership in the world"

    (Bolden, National Association of Investment Companies)
  - Be a Pathfinder to facilitate user access to near-space by supporting development, integration, and flight of the maximum number of scientific payloads on all available commercial reusable suborbital vehicles

"The perfect is the enemy of the good."

"Le mieux est l'ennemi du bien." Voltaire: *Dictionnaire Philosophique* (1764)

- Every scientific payload must be adapted to the specific spaceflight "system"
  - Space Shuttle - CEV - ISS
  - Orbital Free-flyers
    - Commercial
      - DragonLab
    - Foreign
    - SmallSat
    - NanoSat
  - Expendable Near-Space
  - **Reusable Near-Space**



Bion-11 Recovery
- **8:02:30 a.m. January 7, 1997 Northern Kazakhstan**
- **Temperature, -40°C**

- Co-manifested payloads must not interfere with each other
- The Mission/Project Managers job is to get the mission launched while ensuring the maximum scientific return

The goal is publishable scientific data

CRuSR Activities: FY2010

- Organize Level 2 Program Office
- Work with NASA science, technology, & education programs to identify spaceflight research payload candidates (users)
- Work with payload providers to characterize each vehicle's Suborbital Flight Environment (Acceleration, quality of μG, etc.)
- **Work within NASA,with the FAA, and other regulatory agencies to facilitate safe and effective access to Near-Space**
- Facilitate the operations of a commercial payload development/integration industry that will work to move experiments safely and effectively from the laboratory onto Near-Space platforms
- Work with users & industry to identify areas where NASA can best focus our resources (support relevant meetings and conferences)
- **Develop procurement strategy to buy space transportation services**
- Work to identify and transfer NASA technologies needed by Near-Space Industry (launch providers, payload developers, payload integrators, etc.)

CRuSR Procurement Strategy

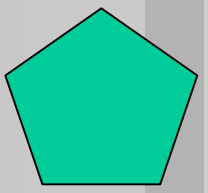
- Develop a procurement strategy to implement the Administrator's direction to "buy space transportation services from the emerging reusable spaceflight companies "
  - RFI issued 04 Dec 2009
    - contemplating two significant procurement actions:
      - 1) potential procurement of reusable suborbital spaceflight services
      - 2) solicitation of research investigations
  - RFI Modification 01 - Posted on Dec 18, 2009
    - Clarified methods for response to RFI
  - RFI Modification 02 - Posted on Feb 05, 2010
    - "Some responses to the initial request were marked Proprietary or Confidential which prevents NASA from sharing the data received with the research community and which also makes it very difficult to solicit research proposals tailored to the vehicle platforms.

CRuSR Safety Overview

- CRuSR Safety has 2 régimes
  - **Payload safety** (is the payload safe for flight)
    - Safe for human passengers & crew
    - No noxious attributes
    - Safe function = non-hazardous to vehicle
    - Non-interference
      - With vehicle
      - With other payloads
  - **Human safety** (is the flight environment safe)
    - Includes all aspects of payload safety
    - Vehicle safety and reliability

Commercial Space Payload Safety Overview

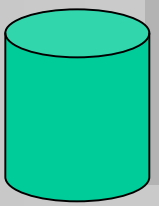
- Commercial Space Safety has 2 separate tracks
  - Government owned and operated



Government Owned and Operated Payload

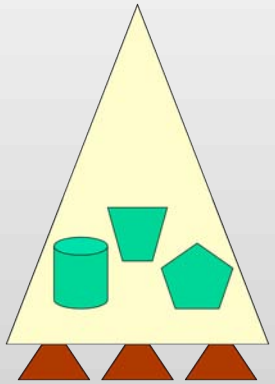
- Government Assurance of:
  - Safety
  - Functionality
  - ICD compliance
  - Integration processes

  - Privately owned and operated



Privately Owned and Operated Payload

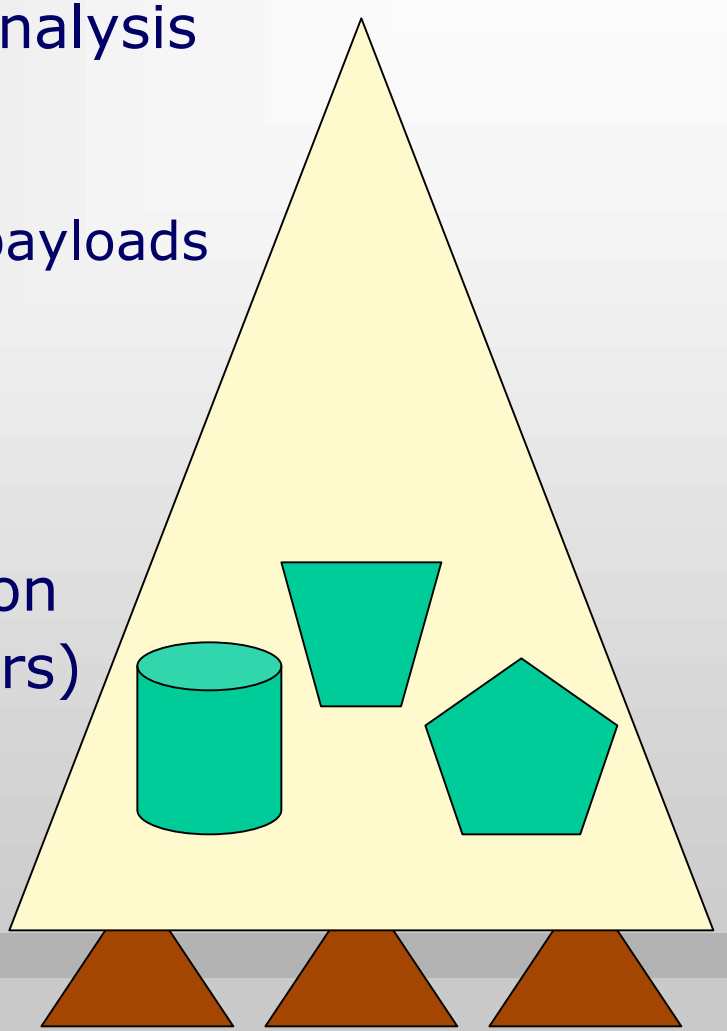
- Commercial Assurance of:
  - Safety
  - Functionality
  - ICD compliance
  - Integration processes
  - ***FAA Regulatory Compliance***



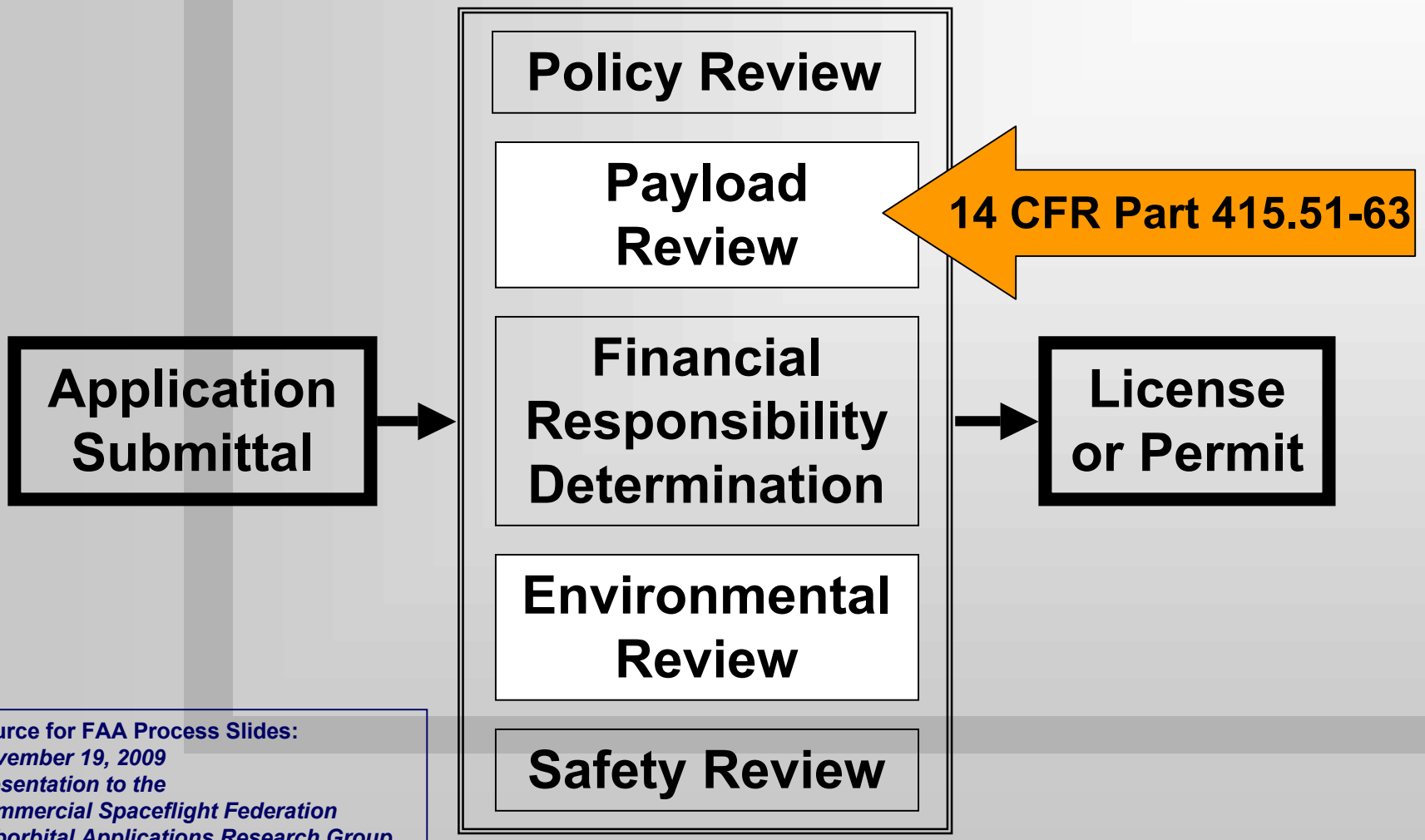
Flight

CRuSR - Payload Safety

- Traditional NASA Payload Safety Analysis
  - Vehicle interfaces
  - Individual Payloads
  - Interactions between vehicle and payloads
  - Interactions between payloads
- Who performs this analysis for Commercial Launches
- Launch Provider carries ultimate responsibility for safety and function
- Launch Providers (and their insurers) will need to have some level of insight into all payloads (even proprietary research)
- Who serves this function
  - Third party bonded payload integrators?



Licensing / Permitting Process Flow
FAA-AST Reviews, Approvals, and Determinations



Source for FAA Process Slides:
November 19, 2009
Presentation to the
Commercial Spaceflight Federation
Suborbital Applications Research Group
Ken Davidian
EFP Program Lead

FAA Payload Process Flow

- The FAA reviews a payload proposed for launch or reentry to *determine whether a license applicant or payload owner or operator has obtained all required licenses, authorizations, and permits, unless the payload is exempt from review*.
- Each payload is subject to compliance monitoring by FAA before launch, unless otherwise exempt.

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Is My Payload Exempt?

- **You Are Exempt If…**
  - … your payload is subject to the regulation of the FCC or DoC/NOAA.
  - … your payload is owned and operated by the government of the United States.
- **If You Are Not Exempt…**
  - … A payload review may be requested as part of a license application review.
  - … A payload review may be requested by the payload owner in advance of or apart from a license application.

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Payload Review Details

- Why Information is Required
  - To identify and address possible safety and policy issues related to the payload.
  - To conduct any necessary interagency review.
- Who Conducts the Payload Review
  - The FAA coordinates a payload review with other gov't agencies (DoD, DoS, DoC, NASA, FCC, etc.)
- Considerable detail may be necessary for cases which present potential unique safety concerns.
  - Payload physical characteristics, functional description, operations
- The FAA will issue a payload determination unless policy or safety considerations prevent launch of the payload.

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Payload Review Info Required

- Payload name
- Payload class
- Physical dimensions and weight of the payload
- Payload owner and operator, if different from the person requesting payload review
- Orbital parameters for parking, transfer and final orbits
- Hazardous materials
- Intended payload operations during the life of the payload
- Delivery point in flight at which the payload will no longer be under the licensee's control

Source: 14 CFR 14 §415.59 Information requirements for payload review.

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CRuSR Needs Your Help

"… America needs NASA and private industry to work to achieve our national goals in space. This means that NASA must determine efficient and effective ways to leverage the power, and innovation of American industry and the American entrepreneur."

"Help us determine how we can create a more effective partnership between the genius of the American entrepreneur and the power of the federal government."

Remarks by NASA Administrator Charles Bolden
at the National Association of Investment Companies Washington, DC; 20 Oct 2009

- *CRuSR is soliciting input from user, provider, regulatory, and commercial infrastructure communities so that it may better support the use and development of a robust and vibrant Near-Space industrial community*

CRuSR

“Do what you can, with what you have, where you are”
Theodore Roosevelt

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Questions?

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